April 19, 2004

TRAFFIC ENGINEERING DIRECTIVE

106-1

SUBJECT: PROCEDURE FOR CONDUCTING TRAFFIC IMPACT STUDIES

In order to establish uniform Traffic Impact Study content, the following criteria shall be used:

WHEN A TRAFFIC IMPACT STUDY IS REQUIRED

A traffic impact study (TIS) will be required under any of the following conditions:

1. **When the proposed development is projected to generate 100 or more trips per hour during the peak generating time for the development.**
2. **For smaller developments under one of the following three conditions:**
   a. **When the proposed new approach is to an intersection already operating at LOS "D" or worse,**
   b. **when the developer is requesting a new traffic signal,**
   c. **when modifications of an existing traffic signal is being requested.**
3. **An older TIS may need to be updated when the data is more than two years o.d.**

A TIS may not be required in situations where the project's impact on traffic is obvious and where the Division of Highways is agreeable to the proposed mitigation measures without conducting a TIS.

CERTIFICATION BY PROFESSIONAL ENGINEER

A professional engineer registered in West Virginia must certify all traffic impact studies.

SCOPE OF WORK

Prior to beginning the TIS, the consultant shall contact the Traffic Engineering Division to discuss the scope of the study. This will include intersections that are to be studied in the traffic impact study and the type of development being planned. Additionally, prior to beginning detailed analyses as part of the traffic impact study a preliminary submission should be made to the Traffic Engineering Division that will include proposed locations of new approaches, existing turning movement counts, and trip distribution percentages for

all intersections and interchanges. It would be in the developer's best interest not to proceed with completing the TIS until being notified by the Traffic Engineering Division that his preliminary submission is acceptable.

TRAFFIC PROJECTIONS

Traffic projections should be made utilizing the latest edition of Trip Generation published by the Institute of Transportation Engineers. Additional studies and references can be provided as needed to supplement the information in Trip Generation. The projected trips for each entity of the development shall be displayed on a chart showing the entering and exiting volume per hour during all affected peak hours.

Shopping centers and other commercial facilities should be designed for a typical Friday afternoon and Saturday mid-day. Background traffic counts should be conducted during favorable weather conditions as a minimum for every hour on a Friday afternoon between 3:00 and 6:00 p.m. and for every hour on a Saturday between 11:00 a.m. and 2:00 p.m. Each intersection should be counted on the same Friday and Saturday and these days should be consecutive. All trip distribution percentages and their justification should be included in the report. Residential and industrial development should be designed for the Friday morning and afternoon peak hour of the roadway which will usually be between 7:00 a.m. and 9:00 a.m. and from 4:00 p.m. to 6:00 p.m. The percent of trucks on the main highway and in the development may be a consideration and should be counted where appropriate.

For most residential and commercial developments, the consultant shall provide the traffic projections and analyses for the year that final build-out is expected. For larger developments, the WVDOT may require projections further into the future. In the case of phased construction, traffic projections and analyses shall also be provided for intermediate stages of build-out.

Pass-by trips shall not exceed 15% without prior approval from the WVDOT. Internal capture rates should be discussed with the WVDOT prior to inclusion in the report.

DATA DISPLAY

A diagram shall be provided showing the existing Friday and Saturday Peak hour turning movements at all affected intersections. A separate diagram shall be used to display the projected new trips and pass-by trips. A third diagram shall show the total combined trips. This is not to preclude using additional diagrams and figures as needed.

CAPACITY ANALYSIS

Capacity analysis should be conducted using the latest edition of the Highway Capacity Manual (HCM) published by the Transportation Research Board. Highway Capacity Analyses software such as "HCS" distributed by McTrans, SYNCHRO distributed by Trafficware, or TEAPAC distributed by Strong Concepts may be utilized. Other comparable software using the procedures of the HCM may also be used if prior approval is obtained from the Traffic Engineering Division. The analyses shall be "operations analyses" rather than "planning analyses".

The Level of Service (LOS) of all intersections affected by the proposed development should be no worse than the LOS before the new facility opens. If it is determined that the LOS of an intersection is adversely affected as a result of the proposed development, the traffic impact study should recommend all reasonable improvements (i.e. construction of turn lanes, construction of through lanes, lengthening of turn lanes) to alleviate projected problems. In some instances it may be necessary to worsen the LOS and increase the queue length inside the development to insure that the state highway operates at an acceptable LOS.

Capacity analyses shall be conducted for all intersections for both the Friday and the Saturday peak hour (morning and afternoon peak hour for residential and industrial development). Any internal intersection that could potentially impact the main highway shall also be analyzed. Analysis worksheets showing inputs, LOS, delay, and back of queue shall be included in the report. Charts shall be used when possible to summarize capacity analysis results such as LOS, delay, and back of queue.

Guidelines for the Preparation of Intersection Capacity Analyses are discussed later and provide more specific requirements for the analyses.

GEOMETRIC IMPROVEMENTS

The latest edition of A Policy on Geometric Design of Highways and Streets (Green Book) published by AASHTO should be utilized in conjunction with West Virginia Division of Highways Design Directives to design geometric improvements needed for mitigation. Procedures recommended in the Green Book will be utilized in addition to the Highway Capacity Manual to determine the need for and length of auxiliary lanes. A list or sketch should be included in the report showing any recommendations for mitigation including the recommended lane configuration, storage lengths, traffic control, etc. The report shall include labeled color photos of the project site and 2 or more labeled color photos of each approach to every intersection studied. All color photos shall be 4 inches by 6 inches.

TRAFFIC SIGNALS

The need for any additional traffic signals should be adequately justified utilizing one or more warrants of the Manual on Uniform Traffic Control Devices. The actual design of any new traffic signals will be done by the Traffic Engineering Division of the West Virginia Division of Highways. Any recommendations for signal timing changes should be justified using highway capacity software such as SYNCHRO to account for interconnection of any traffic signals near the development.

OTHER TRAFFIC CONTROL

The need for other traffic control devices such as STOP and YIELD signing, markings, and intersection channelization should be indicated in the report. The traffic control scheme for internal intersections should be designed by the traffic engineer. Traffic control at these intersections may have to be designed in order that inbound traffic will have the right of way. In any event, the design should be such that traffic does not back onto the state highway. Ordinarily, no internal intersections, driveways, or parking aisles will be allowed within 100 feet of the state highway.

CONTENTS OF COMPLETED REPORT

All copies of the traffic impact study report shall be bound with plastic binding, three ring binders, or other appropriate professionally appearing binding. As a minimum the completed traffic impact study report shall contain the following:

1. **Executive summary**
2. **Table of contents**
3. **Summary of the project scope and location**
4. **Existing roadway geometry including distances between intersections and existing turn lane lengths**
5. **Existing peak hour traffic volumes**
6. **Traffic projections for proposed development**
7. **Projected Trip distribution**
8. **Peak hour summary of new trips**
9. **Discussion of pass-by trips and, if needed, internal capture**
10. **Total peak hour trips at build-out**
11. **Summary of HCS analyses**
12. **Summary of problems that will be caused**
13. **Summary of recommendations for mitigating the impact**
14. **Appendix with actual turning movement counts**
15. **Appendix with all calculations and analyses**
16. **Photographs of the site and affected intersections**
17. **Digital copy of all calculations**

GUIDELINES FOR THE PREPARATION OF INTERSECTION CAPACITY ANALYSES

1. **A typical amber time used for intersections is either 3 or 4 seconds with 3 being an absolute minimum to comply with national standards. Amber times depend primarily upon the geometry of an intersection with consideration also being given to the speed. For high speed roadways, longer amber time should be used. Also, for amber times nearing 4.0 seconds, typically an all red phase of one-half second to one second should be used. For example, a typical intersection in a business district would require 3 seconds of amber time with no all red time. A four-lane highway, such as an Appalachian Corridor, would require an amber time of approximately 4 seconds and an all red time of 0.5 to 1.0 second.**

2. **An intersection capacity analysis should have approximately equal delay on opposing approaches. Several iterations should be run until the delay is approximately equal on all approaches.**

3. **Typical cycle lengths range from 90 to 120 seconds in ten second increments. Downtown intersections typically have 90 second cycle lengths. The heavier volume intersections tend to have longer cycle lengths up to 120 seconds. For design purposes, especially for designing the length of turn lanes, cycle lengths of 90 to 120 seconds should be used.**

4. **Actuated traffic signals, although they can vary in cycle length, utilize the same basic principles for analysis purpose. All signalized capacity analyses should use actuated signal phasing for all phases, unless the traffic signals are part of a system. For systems, the signal timing used in the analysis should reflect the existing and proposed system timing using highway capacity software such as SYNCHRO.**

5. **The typical saturation flow rate used is 1900 passenger cars per hour per lane. It should be noted that this may or may not be the default value of the HCS analysis. In any event, this value should be used for design purposes unless field data is provided to justify the use of another value. Saturation flow rates can be determined in the field by measuring the average time between vehicles as they proceed through the green phase of the traffic signal. The first five vehicles must be discarded and the average times between subsequent vehicles should be utilized. The headway between the vehicles is averaged and divided into 3600 seconds per vehicle to arrive at the saturation flow rate in passenger cars per hour. This value will usually be between 1800 to 1950 passenger cars per hour.**

6. **The primary information needed to conduct an intersection capacity analysis is as follows: traffic volume, number of lanes per approach, width and function of lanes, whether parking is prohibited on the approach, heavy vehicle percentage on each approach, the grade on each approach, the peak hour factor on each approach, the arrival type, and the green/amber time for each phase of the signal cycle.**

7. **The typical arrival type utilized is Type 3. This is for a random arrival of vehicles on an approach. Type 4 arrival rate would tend to be a platoon arrival resulting from an adjacent traffic signal. Arrival Type 3 is a default value in the HCS computer program.**

8. **The HCS analysis comes with several values being the default values. Many of these can be changed simply by inputting new values in the program. Any changes to default values shall be justified with calculations or other documented information that is included with the analysis.**

9. **The default value for peak hour factor is 0.90. The peak hour factor can be calculated by dividing the peak hour volume by four times the peak fifteen minute volume within that specific hour. If the peak hour factor is unknown, use the default value of 0.90.**

10. **The existing geometric conditions and traffic volumes at an intersection should be analyzed first and used as a base analysis. Additional analyses to reduce the delay and improve the Level of Service (LOS) of the intersection may be run by adding turn lanes, etc.**

11. **At a signalized intersection on an expressway having a speed limit of at least 50 miles per hour, a protected only left turn phase should be provided on the main line approaches. Right turns from the side street approaches can be allowed during the mainline left turn phase. Right turns on red will not be permitted from side streets during the mainline through movement's green time.**

12. **For the initial unmet demand, use the default of 0 vehicles. This simply indicates the number of vehicles waiting at the beginning of the signal phase.**

13. **Minimum green times for stand-alone traffic signal phases should be 10 seconds.**

14. **An electronic version (disk or CD) of all analyses shall be included with the traffic impact study.**

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